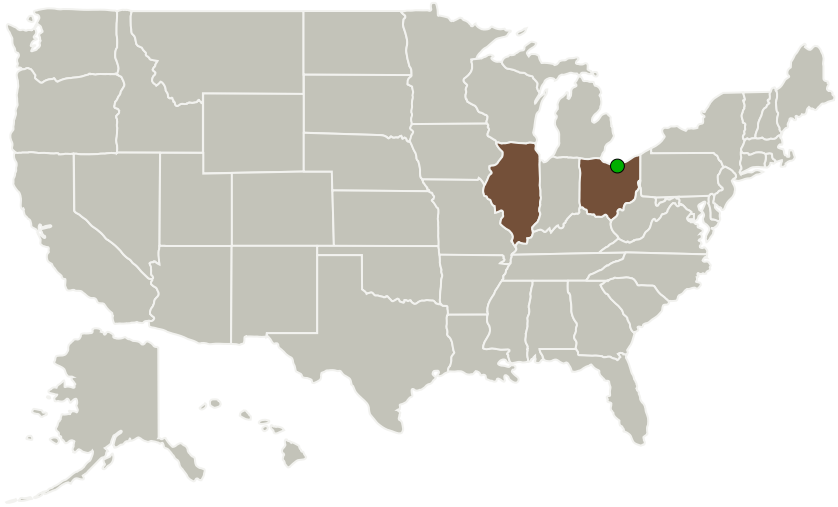
High-Efficiency, Radiation-Hard, Lightweight IMM Solar Cells, Phase I

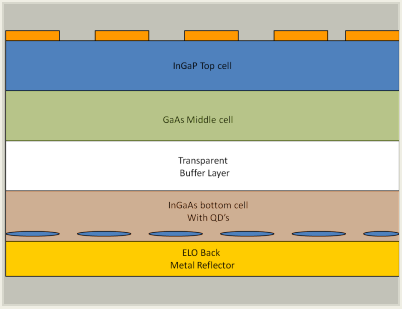
Completed Technology Project (2014 - 2014)

Project Introduction

Future NASA exploration missions require high specific power (>500 W/kg) solar arrays. To increase cell efficiency while reducing weight and maintaining structural integrity, we propose an approach to cell design that involves the use of quantum dots and epitaxial lift-off. In the near term, this approach will allow us to improve on what are currently the best space solar cells available in terms of efficiency and material properties for space utilization. In the proposed Phase I project, MicroLink and its collaborator, Rochester Institute of Technology, will incorporate InAs quantum dots (QDs) in the InGaAs subcell of an InGaP/GaAs/InGaAs triple-junction solar cell to increase radiation tolerance and efficiency, thereby improving end-of-life performance of the solar cell by >5%. By incorporating quantum dots into the InGaAs third cell, we will also extend the wavelength absorption range of InGaAs cell to beyond 1,250 nm, thereby increasing the current produced in the bottom subcell. The quantum dot-enhanced subcell will be the last grown solar cell in an inverted metamorphic (IMM) format on GaAs and will be compatible with MicroLink's epitaxial lift-off (ELO) process. Innovative light management techniques such as reflective metal back contact will be employed to increase absorption in the solar cell by promoting photon recycling.

Primary U.S. Work Locations and Key Partners





High-Efficiency, Radiation-Hard, Lightweight IMM Solar Cells Project Image

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Organizations Performing Work	Role	Type	Location
MicroLink Devices, Inc.	Lead Organization	Industry Minority-Owned Business	Niles, Illinois
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Illinois	Ohio

Project Transitions

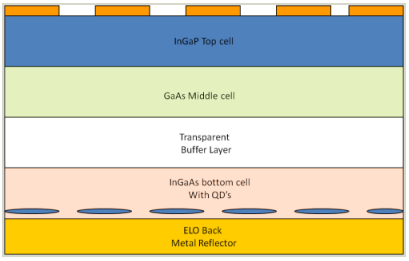
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140591)*

Images



Project Image
High-Efficiency, Radiation-Hard, Lightweight IMM Solar Cells Project Image
(https://techport.nasa.gov/image/126999)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
MicroLink Devices, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Sudersena Rao Tatavarti Bharatam

Co-Investigator:
Rao Tatavarti

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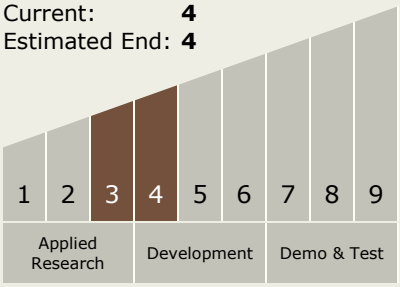
Completed Technology Project (2014 - 2014)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.1 Photovoltaic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System